DOI: https://doi.org/10.4038/sajbi.v5i4.86

# Digital Supply Chain Traceability and Supply Chain Resilience in Sri Lankan Apparel Exporters: The Mediating Role of Operational Decision-Making Speed

South Asian Journal of Business Insights
2026, Special Issue, 42-67
ISSN 2773-7012 (print)
ISSN 2773-6997(online)
© 2026, Faculty of Management and Finance University of Ruhuna, Sri Lanka



P.S.D. Punchihewa*
Department of Management and Entrepreneurship, Faculty of Management and Finance, University of Ruhuna, Sri Lanka

## Abstract

Supply chain resilience has emerged as a critical capability for firms operating in increasingly fragile, uncertain, and disruption-prone global supply networks. For export-oriented industries such as apparel, the ability to respond rapidly and recover effectively from disruption is central to sustaining competitiveness. In this context, digital supply chain traceability (DSCT) has become an important digital capability because it enhances the capture, tracking, and retrieval of critical supply chain information across sourcing, production, and distribution activities. Yet, despite growing interest in digital transformation, existing research has paid limited attention to DSCT as a distinct organizational capability and has provided insufficient explanation of how it is associated with resilience outcomes. This study addresses this gap by examining the association between DSCT and supply chain resilience (SCR), with operational decision-making speed (ODMS) examined as a mediator, in apparel exporting firms in the Western Province of Sri Lanka. Drawing on Organizational Information Processing Theory and the Dynamic Capabilities View, the study examines the associations among DSCT, ODMS, and SCR. Survey data were collected from managerial and executive-level employees (N = 210) and analysed using partial least squares structural equation modelling (PLS-SEM). The findings indicate significant positive associations between DSCT, ODMS, and SCR, with ODMS partially mediating the association between DSCT and SCR. These findings suggest that the strategic value of traceability extends beyond visibility and transparency, as DSCT is also associated with faster operational decision-making and stronger resilience. The study advances resilience literature by identifying a process-based explanation linking digital capability and resilience, while providing actionable implications for apparel exporters seeking to develop more responsive and robust supply chains.

***Keywords:*** Digital supply chain traceability, Operational decision-making speed, Supply chain resilience, Apparel exporting firms

* Corresponding Author – dilshanipunchihewa@gmail.com

## Introduction

Contemporary supply chains operate in an environment of recurring disruptions, rising uncertainty, and growing interdependence across global production and distribution networks, making resilience a central concern for firms competing in international markets (Katsaliaki et al., 2022; Paul & Saha, 2025; Ponomarov and Holcomb, 2009). In this regard, the concept of supply chain resilience is progressively considered as the ability to predict, absorb, respond and recover during disruptions and continue with critical operations (Chowdhury et al., 2024; Katsaliaki et al., 2022). Consequently, resilience is no longer regarded as a defense measure against crisis, but rather as a strategic resource that helps maintain continuity, flexibility, and competitiveness in turbulent environments (Pu et al., 2023).

As a way of responding to these challenges, the process of digital transformation has become a central facilitator of supply chain resilience by enhancing the visibility and connectivity and coordination of supply chain actors (Abeyruwan et al., 2025; Jayasinghe et al., 2026). Digital supply chain traceability (DSCT) is one of such digital capabilities that has received growing interest (Chan, 2022; Kumar and Sharma, 2021). DSCT is the capability to acquire, track, monitor, and disseminate data concerning materials, products, and transactions throughout various phases of the supply chain (Chan, 2022; Li et al., 2025). Traceability systems can benefit firms by increasing their capacity to identify disruptions, locate components that have been impacted, and organize responses more efficiently by providing real-time visibility of supply chain processes (Chan, 2022; Olsen and Borit, 2013).

Traceability is especially relevant to textile and apparel supply chains, where sourcing configurations are globally distributed, the life cycle of the product is brief, and buyer expectations are high (Chan, 2022). In Sri Lanka, the apparel export sector represents the country's largest export industry, generating approximately US$ 5.15 billion in export earnings and employing over 300,000 workers (Sri Lanka Export Development Board, 2025). Most recent industry developments, including traceability systems via QR introduced by Sri Lanka Apparel (2024) prove that the process of traceability becomes an operational requirement influenced by the global transparency, sustainability, and regulatory requirements. These trends underscore the increasing significance of traceability as a strategic capability in the export oriented apparel industry of Sri Lanka (Sri Lanka Apparel, 2024).

Despite this increasing adoption, existing research studies has largely focused on broader digitalization constructs or general resilience drivers, rather than examining digital supply chain traceability as a distinct capability (Abeyruwan et al., 2025; Jayasinghe et al., 2026). More to the point, there is a paucity of empirical data on how traceability is converted into resilience outcomes in practice. Although recent studies have linked digitalization and traceability with supply chain resilience (Poku et al., 2025; Piprani et al., 2025), the mechanism through which traceability-enabled information is translated into resilient action remains insufficiently explained.

While traceability enhances information availability, the value of such information depends on how quickly it is interpreted and acted upon during disruption events (Abeyruwan et al., 2025). This implies a process mechanism behind digital traceability and resilience. This suggests that operational decision-making may represent an important process mechanism linking digital traceability with resilience.

The apparel export industry in Sri Lanka offers a highly relevant empirical context within the study of these relationships (Sri Lanka Export Development Board, 2025). The sector serves major global markets, including the United States, the United Kingdom, and the European Union, comprises approximately 300 manufacturers, and provides direct employment to over 300,000 individuals (Sri Lanka Export Development Board, 2025). Due to the fact that the industry is firmly rooted in buyer-driven global supply chains, Sri Lankan apparel exporters experience the continuous pressure created by market uncertainty, buyer expectations, and the risk of disruption throughout sourcing, production, and logistics (Sri Lanka Export Development Board, 2025; Sri Lanka Apparel, 2024). In such circumstances, continuity and quick disruption recovery are crucial to support export competitiveness and supply chain sustainability in the long-term (Sri Lanka Export Development Board, 2025; Katsaliaki et al., 2022).

This study addresses this gap by examining operational decision-making speed (ODMS) as a mediating mechanism through which digital supply chain traceability is associated with supply chain resilience. The speed of operational decision-making is the degree to which managers can spot disruptions, assess options, authorize decision-making and take corrective action promptly (Baum and Wally, 2003; Kumar and Sharma, 2021). The faster decision-making is particularly critical in the context of supply chains, where the delay can increase the effects of disruptions in sourcing, production, and logistics.

The study is grounded in Organizational Information Processing Theory and the dynamic capabilities perspective. The Organization Information Processing Theory holds that companies need timely and appropriate information-processing mechanisms to lessen uncertainty and enhance effectiveness in decision-making (Tushman and Nadler, 1978). Simultaneously, the dynamic capabilities perspective underlines the significance of sensing, seizing, and reconfiguring resources in relation to shifting environments (Teece et al., 1997). In this context, digital traceability amplifies information-processing ability, and operational decision-making speed enables firms to convert information into adaptive responses, which increase their resilience.

This study employs quantitative cross-sectional survey design based on empirical evidence in the form of data collected on managerial and executive-level employees engaged in supply chain and operational activities in Sri Lankan apparel exporting companies. A cross-sectional design is suitable in order to capture existing organizational practices and associations among constructs. Nevertheless, it does not allow inference of cause and effect, or dynamic changes through time. In line with this, the results can only be taken to reflect associations, but not causal effects.

This study makes three key contributions. First, it contributes to the supply chain resilience literature by conceptualizing digital supply chain traceability as a distinct digital capability rather than a component of broader digitalization constructs. Second, it provides a process-based

explanation by identifying operational decision-making speed as a mediating mechanism linking traceability and resilience. Third, it offers context-specific empirical evidence from Sri Lanka's apparel export sector, thereby extending resilience research to an emerging economy setting characterized by export dependency and increasing traceability requirements.

## Literature Review

### *Supply Chain Resilience*

Supply chain resilience (SCR) has become a significant construct due to the growing disruption, uncertainty, and complexity in global supply networks (Chowdhury et al., 2024; Katsaliaki et al., 2022). It is commonly described as an ability of a supply chain to anticipate, prepare, respond and recover any disruption and continue its operations (Chowdhury and Quaddus, 2016; Ponomarov & Holcomb, 2009). More recent approaches further expand this definition to include adaptive learning and reconfiguring capabilities that allow firms to adapt to disruptions in the future (Ambulkar et al., 2015; Katsaliaki et al., 2022).

Theoretically, resilience is frequently described as dynamic capacity enabling companies to detect shocks, capture suitable reactions, and re-align resources in response to dynamic circumstances (Katsaliaki et al., 2022; Teece et al., 1997). The conceptualization of supply chain resilience in this study is a multidimensional capability that includes readiness, response capability, recovery capability, and adaptation/learning, which is aligned with previous empirical research findings (Ambulkar et al., 2015; Chowdhury and Quaddus, 2016). Thus, in the present study, supply chain resilience is positioned as a dynamic organizational capability rather than a performance outcome, although it can generate outcomes such as operational continuity and recovery.

### *Digital Supply Chain Traceability*

Digital supply chain traceability (DSCT) is defined as the capability to record, monitor, trace, recall, and distribute the data about the materials, products, and supply chain transactions at numerous steps of the supply chain with the help of digital technologies (Chan, 2022; García-Torres et al., 2021; Olsen and Borit, 2013). RFID, Internet of Things (IoT), enterprise systems, and blockchain technologies have contributed greatly to the effectiveness of firms in adopting traceability systems in real time (Agrawal and Pal, 2019; Chan, 2022).

Traceability should not be confused with related constructs like visibility and transparency. Visibility is the degree of access to supply chain information in real-time, whereas transparency represents the degree of distribution of the same information among the stakeholders (Katsaliaki et al., 2022; Olsen and Borit, 2013). Conversely, traceability is a particular aspect that deals with the capacity to monitor and trace the history, whereabouts, and movement of products and materials through the chain stages (Olsen and Borit, 2013).

The conceptualization of DSCT in the present study is based on upstream traceability, internal process traceability, downstream traceability, and data integration and retrieval (Agrawal and Pal, 2019). Such a multidimensional structure is suggestive of the working reality of supply chains, particularly in the context of the apparel-related industries where it is essential to monitor

the material provenance, manufacturing processes, and supply chain flows (Agrawal and Pal, 2019; Chan, 2022).

### *Operational Decision-Making Speed*

Operational decision-making speed (ODMS) is the degree to which managers can quickly identify operational disruptions, consider alternative actions, approve actions, and take corrective measures (Baum and Wally, 2003; Kumar and Sharma, 2021). Although speed of decision has been extensively researched on the strategy environment, its operational aspect is crucial in the supply chain environment, where delays may intensify the effects of disruption in several functions (Bronzo et al., 2024; Kumar and Sharma, 2021).

ODMS may be viewed as a process capability that connects the availability of information and action. Managers in the disruption scenario need to process the complex and time-sensitive information in the procurement, production, and logistics departments in situations of uncertainty (Kumar and Sharma, 2021). Rapid decision-making minimizes response lag, operational disruptions, and enhances recovery (Baum & Wally, 2003). ODMS is operationalized as problem recognition speed, alternative evaluation speed, decision authorization speed, and execution coordination speed in this research.

### *Digital Traceability and Supply Chain Resilience*

The empirical data show that digital technologies may be applied to make the supply chain more resilient by improving the quality of information, coordination, and responsiveness (Iftikhar et al., 2024; Ivanov and Dolgui, 2020; Katsaliaki et al., 2022). In this respect, digital traceability is highly important because it enables companies to identify the source, state, and place of materials and products in the event of disruption (Chan, 2022; Olsen and Borit, 2013).

Traceability systems increase resilience by enabling the detection of disruptions, isolating impacted components, communicating with supply chain partners, and regaining operational continuity with less uncertainty (Agrawal & Pal, 2019; Chan, 2022). These features are especially significant in sectors, such as apparel, where supply chains are spread all over the world, and the delivery in time is essential (Katsaliaki et al., 2022). However, although existing evidence generally supports a positive association between digital traceability and supply chain resilience, the extent and conditions under which traceability contributes to resilience remain insufficiently understood. In particular, further empirical evidence is needed to clarify how digital traceability strengthens firms' ability to detect, respond to, and recover from supply chain disruptions.

H1: Digital supply chain traceability is positively associated with supply chain resilience.

### *Digital Traceability and Operational Decision-Making Speed*

Digital traceability is not merely a storage of information; it is also in the capacity to make decisions more efficiently and promptly when there are operational upheavals (Chan, 2022). By implementing timely and correct information about suppliers, materials, and production status,

the managers can identify issues earlier and minimize uncertainty in assessing response solutions (Kumar and Sharma, 2021; Li et al., 2025).

In terms of Organizational Information Processing Theory, organizations in a state of uncertainty need more information-processing capacity in order to minimize ambiguity and enhance the effectiveness of decisions (Tushman and Nadler, 1978). Digital traceability improves this ability by reducing the time and effort required to obtain, verify, and interpret disruption-related information. Consequently, managers can identify operational problems and evaluate response alternatives more quickly, facilitating faster decision-making processes.

H2: Digital supply chain traceability is positively associated with operational decision-making speed.

***Operational Decision-Making Speed and Supply Chain Resilience***

The speed of operational decision-making is a key determinant of the supply chain resilience due to its direct impact on the responsiveness and recovery time of firms to the disruption (Baum and Wally, 2003; Kumar and Sharma, 2021). Beyond general responsiveness, faster decision-making can help firms contain disruption effects, mobilize alternative resources, and coordinate recovery actions before disruptions propagate across supply chain activities (Kumar and Sharma, 2021). By making decisions more quickly, firms can limit the impact of disruptions, ensure continuity in operations, and recover performance more successfully (Kumar and Sharma, 2021).

According to the dynamic capabilities perspective, resilience is not a matter of the presence of resources but rather the rate at which the companies can mobilize and restructure such resources (Teece et al., 1997). ODMS captures this ability by the rate at which firms convert information to action in response to disruption events.

H3: Operational decision-making speed is positively associated with supply chain resilience

***Mediating Role of Operational Decision-Making Speed***

Digital traceability can have a direct positive effect on resilience, but the actual effect is probably not to be achieved without proper and prompt decision-making. Data itself is not valuable unless it is viewed and processed in real time (Kumar & Sharma, 2021; Li et al., 2025). This implies that the speed of operational decision-making is a key mechanism that connects traceability with resilience.

Digital traceability enhances the accessibility and precision of information pertaining disruption, and ODMS defines the speed of converting this information into operational responses. ODMS, in this sense, represents an important decision-making process through which the seizing function of dynamic capabilities can be enacted, connecting information processing with adaptive action (Teece et al., 1997).Thus, the connection between DSCT and SCR will be both direct and indirect via ODMS.

H4: Operational decision-making speed mediates the relationship between digital supply chain traceability and supply chain resilience.

***Theoretical Foundation***

The proposed research is based on the Organizational Information Processing Theory (OIPT) and the dynamic capabilities viewpoint (DCV) which complement each other in explaining the suggested relationships. Specifically, OIPT explains how digital traceability strengthens the processing of disruption-related information, whereas DCV explains how firms convert this information into timely adaptive action and resilience.

Organizational Information Processing Theory implies that companies that exist in an uncertain environment need the ability to process information in a timely manner and in a relevant way to minimize ambiguity and enhance effective decision-making (Tushman and Nadler, 1978). In supply chain contexts, disruptions bring both more uncertainty and more information, and effective information processing is vital. Digital supply chain traceability complements this by offering precise, timely, and accessible information on materials, processes, and logistics flows (Chan, 2022). Nonetheless, the access to information does not guarantee the successful results; it has to be handled and taken into action as fast as possible.

This perspective is supplemented by the dynamic capabilities perspective where the ability to respond to changes in the environment by sensing, seizing, and reconfiguring of resources is emphasized (Teece et al., 1997). In this context, digital traceability is used to enhance the sensing of disruptions, and speed of operational decision-making is taken to be the capability of the firm to take opportunities and react in a short period. Supply chain resilience reflects the capability of the firm to reorganize operations to respond to disruption.

Collectively, these views imply that digital traceability supports information-processing capability whereas operational decision-making speed facilitates the conversion of information into responsive action. This is a holistic process that enhances supply chain resilience.

## Methodology

The present study is based on a quantitative research design to investigate the correlations between digital supply chain traceability (DSCT), speed of operational decision-making (ODMS), and supply chain resilience (SCR). A cross-sectional survey method was used to encompass the current managerial perceptions and company practices in the exporting apparel firms. Although the design is suitable to test relationships between latent constructs, it cannot be used to make a causal inference, thus the results could be viewed as associative but not causal (Maier et al., 2023).

The target group consisted of managerial and executive level staff of the Sri Lankan apparel exporting companies, specifically those who are engaged in the operations of the supply chain management, logistics, procurement, merchandising, production planning, and operations in the western province of Sri Lanka. These respondents were chosen because they were directly involved in operations decision-making and supply chain operations. Initially, Purposive sampling method was applied to identify the respondents eligible and then snowball sampling

was applied to increase the sample using professional networks. Though this method allowed reaching a specialized respondent group, it can be restrictive in terms of generalizability because the sampling was not probability based (Dosek, 2021). The unit of analysis was the firm, with data collected from managerial and executive-level employees who were considered knowledgeable informants regarding their firms' traceability, decision-making, and resilience practices.

To execute the sampling plan, the initial participants were identified from researcher's professional and academic networks in the Sri Lankan apparel industry. The respondents were directly contacted through email and internet mediums (Google Forms, LinkedIn messaging, etc.) to share the survey link. In some cases, contacts within firms helped distribute the questionnaire among other relevant employees. Then, snowball sampling was employed by asking initial respondents to forward the survey link to other managers, executives, and senior employees engaged in supply chain activities in their firms or professional networks. This allowed access to a larger sample of experienced respondents from various firms, and especially when access to some firms was restricted (Dosek, 2021). Thus the use of purposive and snowball sampling was suitable to gain access to a targeted and knowledgeable respondent group, though it may lead to network bias and restrict the generalizability of the findings. It received 227 responses. Following data screening, 17 responses were eliminated on the basis of incompleteness or inconsistency and no duplication responses were detected. The ultimate analytical sample size was 210 respondents, which exceeds the minimum sample-size requirements for the estimated PLS-SEM model and was considered adequate for the analysis (Hair et al., 2019). The demographic profile of the respondents is provided in Table 2. Respondents took part on a voluntary basis and were made aware of the study purpose. The confidentiality and anonymity were guaranteed, and no personally identifiable information were taken. Participation was done with informed consent.

The questionnaire was constructed in a systematic way using previously recognized multi-item scales. In particular, DSCT items were modified according to Agrawal and Pal (2019) and Chan (2022), operational decision-making speed items were adjusted based on Baum and Wally (2003) and Kumar and Sharma (2021), and supply chain resilience items were adapted according to Ambulkar et al. (2015) and Chowdhury and Quaddus (2016). The responses were all measured with a five-point Likert scale (ranging between 1 (strongly disagree) and 5 (strongly agree)). The questionnaire was pilot tested before the main data collection with a small sample of respondents and subject experts (n = 15) to determine clarity, wording, and contextual relevance. Considering feedback, some minor changes were introduced to enhance the clarity of the items and guarantee content validity.

The SPSS and SmartPLS were used to analyze the data. Preliminary screening and descriptive statistics were performed using SPSS (version 26) and the estimation of the measurement and structural models was conducted with SmartPLS (version 4) through partial least squares structural equation modeling (PLS-SEM). PLS-SEM was preferred because the study emphasizes prediction and explanation of the relationships among the constructs, rather than theory confirmation, and the model includes a mediation relationship(Hair et al., 2019).The bootstrapping was conducted with 5,000 resamples having a two-tailed test at 95% confidence level and bias-corrected and accelerated (BCa) confidence intervals (Preacher & Hayes, 2008).

The dataset was filtered before model estimation to remove missing values and inconsistencies. Screening allowed the removal of cases with a lot of missing data and there were no significant missing values that would have to be imputed in the final dataset. PLS-SEM is not based on the assumption of normal data, but skew and kurtosis were analyzed to determine the possibility of extreme deviations, and all values fell within reasonable limits (+-3).

Since the data were gathered using only one survey instrument, common method bias (CMB) was evaluated. The single-factor test conducted by Harman showed that no single factor explained most of the variance, implying that common method bias was not a significant problem (Podsakoff et al., 2003). Moreover, the values of inner variance inflation factor (VIF) were analyzed and were below the suggested value of 3.3, which indicates further the lack of significant common method bias.

A two-step analysis procedure was used, as suggested by Hair et al. (2019). The measurement model was initially assessed on the reliability of the indicators (outer loadings), internal consistency reliability (Cronbachs alpha and composite reliability), convergent validity (average variance extracted), and discriminant validity (Fornell-Larcker criterion and HTMT). Second, the structural model was evaluated by examining path coefficients and their significance through bootstrapping, as well as the coefficient of determination (R2), effect size (f2) and predictive relevance (Q2) through blindfolding processes.

Based on the theoretical arguments and hypotheses developed, the conceptual framework of the study is presented in Figure 1.

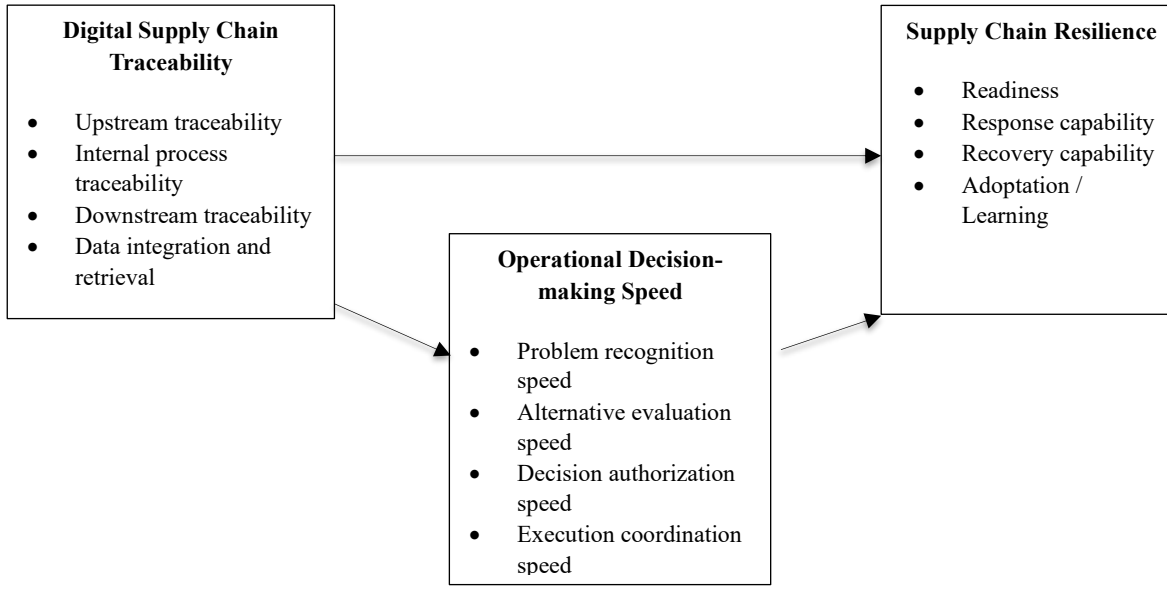



Figure 01: Conceptual Framework

The questionnaire items were adapted and refined based on prior literature, standards, and conceptual frameworks relevant to digital supply chain traceability, operational decision-making, and supply chain resilience. The dimensions presented in Table 1 represent conceptual facets used to organize the measurement items, while DSCT, ODMS, and SCR were specified as the respective latent constructs in the empirical PLS-SEM model rather than as second-order constructs.

Table 01: Operationalization of Study variables

| Variable | Dimension | Indicators | Source |
|---|---|---|---|
| Digital Supply Chain Traceability | Upstream traceability | DSCT1: Our firm can digitally identify the origin of key raw materials used in export orders. | Chan (2022); GS1 (2017); Agrawal & Pal (2019) |
| | | DSCT2: Our firm can digitally trace supplier and sub-supplier information for critical materials. | |
| | Internal process traceability | DSCT3: Our firm can digitally link material lots or batches to internal production stages. | Chan (2022); GS1 (2017); Agrawal & Pal (2019) |
| | | DSCT4: Our firm can trace work-in-progress status and major process events across production operations. | |
| | Downstream traceability | DSCT5: Our firm can digitally trace finished goods from production completion to shipment. | Chan (2022); GS1 (2017); Agrawal & Pal (2019) |
| | | DSCT6: When a logistics problem occurs, our firm can quickly identify which orders, buyers, or shipments are affected. | |
| | Data integration and retrieval | DSCT7: Traceability data are integrated across sourcing, production, warehouse, and logistics functions. | Chan (2022); GS1 (2017); Agrawal & Pal (2019) |
| | | DSCT8: Required traceability information can be retrieved quickly and accurately when needed. | |

| | | | |
|---|---|---|---|
| Operational Decision-Making Speed | Problem recognition speed | ODMS1: When disruptions arise, managers in our firm identify the operational problem quickly. | Baum & Wally (2003); Kumar & Sharma (2021) |
| | | ODMS2: Relevant information is assembled rapidly to diagnose the operational issue. | |
| | Alternative evaluation speed | ODMS3: Our managers quickly evaluate alternative courses of action during supply chain disruptions. | Baum & Wally (2003); Kumar & Sharma (2021) |
| | | ODMS4: The likely operational consequences of response options are assessed without unnecessary delay. | |
| | Decision authorization speed | ODMS5: Necessary approvals for operational response decisions are obtained quickly in our firm. | Baum & Wally (2003); Kumar & Sharma (2021) |
| | | ODMS6: Managers commit to a disruption response without excessive escalation or delay. | |
| | Execution coordination speed | ODMS7: Once a decision is made, cross-functional implementation begins quickly. | Kumar & Sharma (2021) |
| | | ODMS8: Corrective operational actions are executed rapidly to stabilize supply chain performance. | |
| Supply Chain Resilience | Readiness | SCR1: Our supply chain is well prepared to anticipate and detect potential disruptions. | Chowdhury & Quaddus (2016); Ambulkar et al. (2015) |
| | | SCR2: We maintain contingency arrangements that help us handle unexpected supply interruptions. | |

| | | | |
|---|---|---|---|
| | Response capability | SCR3: During disruptions, our firm responds quickly to maintain product flow and customer commitments. | Chowdhury & Quaddus (2016); Ambulkar et al. (2015) |
| | | SCR4: We coordinate effectively with internal functions and external partners to contain disruption impacts. | |
| | Recovery capability | SCR5: We restore normal supply chain operations quickly after a disruption. | Chowdhury & Quaddus (2016); Ambulkar et al. (2015) |
| | | SCR6: Our supply chain recovers delivery and production performance within a short period after disruptions. | |
| | Adaptation / learning | SCR7: We learn from disruption events and improve our supply chain processes afterward. | Ambulkar et al. (2015) |
| | | SCR8: We can reconfigure sourcing, production, or logistics arrangements to cope with future disruptions. | |

## Results

Table 2 presents the demographic and professional profile of the respondents included in the final sample (N = 210). The sample consists of experienced managerial and executive-level employees drawn from key supply chain-related functions, including supply chain management, logistics, procurement, merchandising, production planning, and operations. Most respondents were between 31 and 40 years of age, and a substantial proportion had more than five years of work experience, suggesting that the respondents were well positioned to provide informed assessments of traceability practices, operational decision-making speed, and resilience capabilities.

Table 02: Profile of Respondents

| Demographic Factor | Category | N | Percentage (%) |
|---|---|---|---|
| Gender | Male | 90 | 42.86% |
| | Female | 120 | 57.14% |
| Age | 20–30 years | 36 | 17.14% |
| | 31–40 years | 82 | 39.05% |
| | 41–50 years | 60 | 28.57% |
| | 51–60 years | 20 | 9.52% |

| | | | |
|---|---|---|---|
| | Above 60 years | 12 | 5.71% |
| Educational Qualification | Diploma | 30 | 14.29% |
| | Bachelor's Degree | 100 | 47.62% |
| | Master's Degree | 48 | 22.86% |
| | Professional Qualification | 22 | 10.48% |
| | Other | 10 | 4.76% |
| Job Designation | Executive Level | 72 | 34.29% |
| | Assistant Manager | 54 | 25.71% |
| | Manager | 44 | 20.95% |
| | Senior Manager | 30 | 14.29% |
| | Other | 10 | 4.76% |
| Years of Experience | Less than 5 years | 42 | 20.00% |
| | 5–10 years | 74 | 35.24% |
| | 11–15 years | 48 | 22.86% |
| | 16–20 years | 26 | 12.38% |
| | Above 20 years | 20 | 9.52% |
| Functional Area | Supply Chain Management | 46 | 21.90% |
| | Logistics | 32 | 15.24% |
| | Procurement | 28 | 13.33% |
| | Merchandising | 26 | 12.38% |
| | Production Planning | 24 | 11.43% |
| | Operations | 34 | 16.19% |
| | Inventory Control | 10 | 4.76% |
| | Other | 10 | 4.76% |

Descriptive statistics indicate relatively high levels across all three constructs. The construct-level mean scores were 3.954 for digital supply chain traceability (DSCT), 3.850 for operational decision-making speed (ODMS), and 3.934 for supply chain resilience (SCR). At the dimensional level, internal process traceability recorded the highest mean within DSCT (M = 4.000), response capability recorded the highest mean within SCR (M = 3.975), and execution coordination speed recorded the highest mean within ODMS (M = 3.905). Although these elevated mean values are common in managerial surveys, they may also indicate response tendency, so common method bias was subsequently assessed.

Normality was examined using skewness and kurtosis statistics. As shown in Table 3, all kurtosis values fall within the acceptable range of ±3, indicating no severe deviations from normality (Hair et al., 2016). Although PLS-SEM does not require strict normality, these results suggest that the data are suitable for multivariate analysis.

Table 03: Mean, SD, and normality test results

| Dimension | Item | N | Mean | SD | Kurtosis | Skewness |
|---|---|---|---|---|---|---|
| Upstream Traceability | DSCT1 | 210 | 3.980 | 0.801 | 1.882 | -0.964 |
| | DSCT2 | 210 | 3.910 | 0.842 | 1.547 | -0.893 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Internal Process Traceability | DSCT3 | 210 | 4.060 | 0.756 | 2.214 | -1.041 |
| | DSCT4 | 210 | 3.940 | 0.815 | 1.736 | -0.901 |
| Downstream Traceability | DSCT5 | 210 | 4.020 | 0.772 | 1.964 | -0.988 |
| | DSCT6 | 210 | 3.880 | 0.853 | 1.423 | -0.874 |
| Data Integration and Retrieval | DSCT7 | 210 | 3.950 | 0.807 | 1.686 | -0.915 |
| | DSCT8 | 210 | 3.890 | 0.829 | 1.358 | -0.842 |
| Problem Recognition Speed | ODMS1 | 210 | 3.840 | 0.861 | 1.174 | -0.796 |
| | ODMS2 | 210 | 3.910 | 0.824 | 1.583 | -0.901 |
| Alternative Evaluation Speed | ODMS3 | 210 | 3.790 | 0.878 | 0.982 | -0.742 |
| | ODMS4 | 210 | 3.860 | 0.845 | 1.266 | -0.816 |
| Decision Authorization Speed | ODMS5 | 210 | 3.770 | 0.893 | 0.934 | -0.721 |
| | ODMS6 | 210 | 3.820 | 0.869 | 1.108 | -0.774 |
| Execution Coordination Speed | ODMS7 | 210 | 3.930 | 0.801 | 1.744 | -0.923 |
| | ODMS8 | 210 | 3.880 | 0.826 | 1.527 | -0.887 |
| Readiness | SCR1 | 210 | 3.960 | 0.778 | 1.895 | -0.978 |
| | SCR2 | 210 | 3.890 | 0.814 | 1.442 | -0.851 |
| Response Capability | SCR3 | 210 | 4.010 | 0.743 | 2.206 | -1.036 |
| | SCR4 | 210 | 3.940 | 0.782 | 1.774 | -0.926 |
| Recovery Capability | SCR5 | 210 | 3.980 | 0.769 | 1.992 | -1.014 |
| | SCR6 | 210 | 3.920 | 0.794 | 1.637 | -0.905 |
| Adaptation / Learning | SCR7 | 210 | 3.870 | 0.836 | 1.281 | -0.807 |
| | SCR8 | 210 | 3.900 | 0.818 | 1.469 | -0.862 |

***Measurement Model Assessment***

The measurement model was assessed in terms of indicator reliability, internal consistency reliability, convergent validity, and discriminant validity following Hair et al. (2019). As shown in Table 4, all outer loadings exceeded the recommended minimum threshold of 0.70, ranging from 0.746 to 0.861. This indicates satisfactory indicator reliability. Cronbach's alpha values ranged from 0.918 to 0.931, while composite reliability values ranged from 0.932 to 0.942,

confirming strong internal consistency across all constructs. In addition, AVE values ranged from 0.632 to 0.671, exceeding the threshold of 0.50 and demonstrating convergent validity. VIF values were all below 5.00, indicating that multicollinearity among indicators was not a concern.

Table 04: Measurement model results

| Variable | Dimension | Indicator | Outer loading (>0.70) | Cronbach's alpha (>0.70) | Composite reliability (>0.70) | AVE (>0.50) | VIF (<5.00) |
|---|---|---|---|---|---|---|---|
| Digital Supply Chain Traceability (DSCT) | Upstream Traceability | DSCT1 | 0.803 | 0.918 | 0.932 | 0.632 | 2.214 |
| | | DSCT2 | 0.811 | | | | 2.358 |
| | Internal Process Traceability | DSCT3 | 0.842 | | | | 2.694 |
| | | DSCT4 | 0.786 | | | | 2.141 |
| | Downstream Traceability | DSCT5 | 0.854 | | | | 2.821 |
| | | DSCT6 | 0.774 | | | | 1.998 |
| | Data Integration and Retrieval | DSCT7 | 0.826 | | | | 2.447 |
| | | DSCT8 | 0.768 | | | | 1.884 |
| Operational Decision-Making Speed (ODMS) | Problem Recognition Speed | ODMS1 | 0.792 | 0.927 | 0.939 | 0.658 | 2.106 |
| | | ODMS2 | 0.824 | | | | 2.473 |
| | Alternative Evaluation Speed | ODMS3 | 0.781 | | | | 2.089 |
| | | ODMS4 | 0.815 | | | | 2.331 |
| | Decision Authorization Speed | ODMS5 | 0.746 | | | | 1.917 |
| | | ODMS6 | 0.759 | | | | 2.004 |
| | Execution Coordination Speed | ODMS7 | 0.847 | | | | 2.765 |
| | | ODMS8 | 0.838 | | | | 2.621 |
| Supply Chain | Readiness | SCR1 | 0.821 | 0.931 | 0.942 | 0.671 | 2.389 |

| | | | | |
|---|---|---|---|---|
| Resilience (SCR) | | | | |
| | | SCR2 | 0.793 | 2.114 |
| | Response Capability | SCR3 | 0.854 | 2.746 |
| | | SCR4 | 0.816 | 2.355 |
| | Recovery Capability | SCR5 | 0.861 | 2.932 |
| | | SCR6 | 0.828 | 2.487 |
| | Adaptation / Learning | SCR7 | 0.779 | 2.051 |
| | | SCR8 | 0.802 | 2.276 |

Discriminant validity was assessed using the Fornell–Larcker criterion and HTMT ratio. As shown in Table 5, the square root of AVE for each construct exceeded inter-construct correlations, satisfying the Fornell–Larcker criterion (Fornell & Larcker, 1981). Furthermore, all HTMT values were below the threshold of 0.90, confirming discriminant validity (Henseler et al., 2015). The HTMT value between ODMS and SCR (0.829), although relatively high, remained below the conservative threshold of 0.90, providing evidence of discriminant validity; the conceptual distinction between decision-making speed and the broader resilience capability further supports their separate treatment in the model. Cross-loadings were examined and showed that each indicator loaded highest on its corresponding construct; therefore, cross-loadings are not discussed further for parsimony.

Table 05. Discriminant validity – Fornell and Larcker criterion

| Variable | DSCT | ODMS | SCR |
|---|---|---|---|
| DSCT | 0.795 | | |
| ODMS | 0.702 | 0.811 | |
| SCR | 0.691 | 0.748 | 0.819 |

Table 06. Heterotrait–Monotrait ratio (HTMT)

| Variable | DSCT | ODMS | SCR |
|---|---|---|---|
| DSCT | | | |
| ODMS | 0.781 | | |
| SCR | 0.764 | 0.829 | |

Further, item-level discriminant validity was assessed using cross-loadings. Each item should load highest on its associated construct and exceed the cross-loadings on other constructs (Chin, 1998; Hair et al., 2016). As shown in Table 7, all indicators loaded more strongly on their own construct than on the other constructs. Accordingly, the measurement model demonstrated adequate discriminant validity at the item level as well.

Table 07. Cross-loadings

| Indicator | DSCT | ODMS | SCR |
|---|---|---|---|
| DSCT1 | **0.803** | 0.572 | 0.531 |
| DSCT2 | **0.811** | 0.598 | 0.544 |
| DSCT3 | **0.842** | 0.621 | 0.573 |
| DSCT4 | **0.786** | 0.557 | 0.524 |
| DSCT5 | **0.854** | 0.633 | 0.601 |
| DSCT6 | **0.774** | 0.548 | 0.517 |
| DSCT7 | **0.826** | 0.614 | 0.592 |
| DSCT8 | **0.768** | 0.539 | 0.504 |
| ODMS1 | 0.564 | **0.792** | 0.589 |
| ODMS2 | 0.601 | **0.824** | 0.636 |
| ODMS3 | 0.552 | **0.781** | 0.571 |
| ODMS4 | 0.586 | **0.815** | 0.614 |
| ODMS5 | 0.517 | **0.746** | 0.552 |
| ODMS6 | 0.531 | **0.759** | 0.566 |
| ODMS7 | 0.629 | **0.847** | 0.673 |
| ODMS8 | 0.618 | **0.838** | 0.661 |
| SCR1 | 0.517 | 0.602 | **0.821** |
| SCR2 | 0.498 | 0.571 | **0.793** |
| SCR3 | 0.573 | 0.654 | **0.854** |
| SCR4 | 0.552 | 0.621 | **0.816** |
| SCR5 | 0.598 | 0.681 | **0.861** |
| SCR6 | 0.566 | 0.642 | **0.828** |
| SCR7 | 0.509 | 0.587 | **0.779** |
| SCR8 | 0.538 | 0.611 | **0.802** |

***Structural Model Assessment***

The structural model was evaluated using the PLS algorithm with path weighting. Bootstrapping was performed with 5,000 resamples using a two-tailed test at a 95% confidence level with bias-corrected and accelerated (BCa) confidence intervals. Inner VIF values were below 3.3, indicating no collinearity concerns.

The coefficient of determination ($R^2$) indicates that DSCT explains 49.3% of the variance in ODMS ($R^2 = 0.493$), while DSCT and ODMS jointly explain 64.8% of the variance in SCR ($R^2 = 0.648$), indicating moderate to substantial explanatory power (Hair et al., 2019). Predictive relevance assessed using blindfolding shows $Q^2$ values of 0.312 and 0.401 for ODMS and SCR respectively, confirming predictive relevance

Table 08. Predictive Relevance and Coefficient Of Determination

| Endogenous variables | $R^2$ | $Q^2$ predict |
|---|---|---|
| Operational Decision-Making Speed (ODMS) | 0.493 | 0.31 |
| Supply Chain Resilience (SCR) | 0.648 | 0.401 |

Effect size ($f^2$) analysis indicates that DSCT has a large effect on ODMS ($f^2 = 0.972$), while DSCT ($f^2 = 0.216$) and ODMS ($f^2 = 0.389$) have medium to large effects on SCR (Cohen, 1992).

The effect size ($f^2$) was used to determine the contribution of each exogenous construct to the endogenous constructs. According to Cohen (1992), 0.02**,** 0.15**,** and 0.35 represent small, medium, and large effect sizes respectively. As shown in Table 9, the effect sizes ranged from 0.216 to 0.972**,** indicating medium to large effects. In particular, digital supply chain traceability had a strong effect on operational decision-making speed, while both digital supply chain traceability and operational decision-making speed had meaningful effects on supply chain resilience.

Table 09. Effect size ($f^2$)

| Relationship | $f^2$ | Interpretation |
|---|---|---|
| DSCT → ODMS | 0.972 | Large |
| DSCT → SCR | 0.216 | Medium |
| ODMS → SCR | 0.389 | Large |

***Hypothesis Analysis***

The study tested three direct effects and one indirect effect**.** The first hypothesis proposed that digital supply chain traceability has a significant positive effect on supply chain resilience**.** The results indicated that the path coefficient between DSCT and SCR was positive and statistically significant **(**$\beta = 0.324$, $p < 0.05$). Therefore, H1 was supported.

The second hypothesis proposed that digital supply chain traceability has a significant positive effect on operational decision-making speed**.** As shown in Table 10, the path coefficient between DSCT and ODMS was positive and significant **(**$\beta = 0.702$, $p < 0.05$**).** Although some DSCT indicators refer to the rapid identification and retrieval of traceability information, DSCT primarily captures the firm's capability to provide visibility and access to supply-chain information, whereas ODMS captures the speed of the managerial decision process, including problem recognition, alternative evaluation, authorization, and execution. The relatively strong DSCT–ODMS relationship ($\beta = 0.702$) may partly reflect this conceptual proximity; however, discriminant validity was supported by the Fornell–Larcker criterion, HTMT (0.781), and cross-loading results. Therefore, the strong relationship is interpreted as evidence that traceability-enabled information can facilitate faster operational decision-making rather than as evidence that the two constructs are redundant. Thus, H2 was also supported.

The third hypothesis examined the effect of operational decision-making speed on supply chain resilience**.** The results showed that ODMS had a significant positive effect on SCR **(**$\beta = 0.536$, $p < 0.001$), thereby supporting H3**.**

Table 10. Path coefficients ($\beta$) and t-statistics

| No. | Effect | Coefficient ($\beta$) | T-statistics | P-value | 95% CI | Result |
|---|---|---|---|---|---|---|
| H1 | DSCT → SCR | 0.324 | 5.982 | <0.001 | (0.218, 0.430) | Supported |
| H2 | DSCT → ODMS | 0.702 | 16.481 | <0.001 | (0.619, 0.785) | Supported |
| H3 | ODMS → SCR | 0.536 | 8.763 | <0.001 | (0.416, 0.656) | Supported |

Although both ODMS and SCR involve responsiveness to operational disruptions, they represent conceptually distinct constructs. ODMS focuses specifically on the speed of the managerial decision process, including problem recognition, evaluation of alternatives, authorization, and coordination of implementation. In contrast, SCR represents the broader organizational capability to anticipate, respond to, recover from, and adapt to supply-chain disruptions. Thus, rapid response is one aspect of resilience, whereas ODMS captures the speed of the decision-making process that can contribute to effective resilience.

Finally, the study assessed the mediating role of operational decision-making speed in the relationship between digital supply chain traceability and supply chain resilience**.** The indirect effect was found to be positive and significant ($\beta = 0.376$, $p < 0.05$), indicating that operational decision-making speed significantly mediates the relationship between digital supply chain traceability and supply chain resilience. Since the direct effect between DSCT and SCR remained significant even after the inclusion of the mediator, the mediation can be interpreted as partial mediation**.** Hence, H4 was supported.

Table 11: The mediation effect of ODMS was examined using bootstrapping

| Effect | β | t-value | 95% CI | Result |
|---|---|---|---|---|
| Indirect (DSCT → ODMS → SCR) | 0.376 | 7.992 | (0.284, 0.468) | Significant |
| Direct (DSCT → SCR) | 0.324 | 5.982 | (0.218, 0.430) | Significant |
| Total Effect | 0.700 | – | – | – |

The indirect effect of DSCT on SCR via ODMS was significant ($\beta = 0.376$, $p < 0.001$), supporting mediation. The total effect was approximately 0.700, and the variance accounted for (VAF) was approximately 54%, indicating partial mediation. These findings confirm that operational decision-making speed acts as a key mechanism through which digital supply chain traceability is associated with supply chain resilience.

## Discussion

The findings of this study provide important insights into how digital supply chain traceability contributes to supply chain resilience in Sri Lankan apparel exporting firms. The profile of the respondents also enhances the trustworthiness of the results, since the majority of the respondents were employees of managerial and executive levels and had direct experience in supply chain and operational operations and had enough working experience to assess traceability practices, decision-making processes, and resilience capabilities in a meaningful way(Baum & Wally, 2003; Kumar & Sharma, 2021).

The initial aim of the research was to investigate the connection between digital supply chain traceability (DSCT) and supply chain resilience (SCR). The findings indicate that there is a positive relationship between DSCT and SCR, which confirms that companies with a high traceability level are in a better position to sustain continuity and handle disruptions in an effective manner. This observation aligns with the analysis of Katsaliaki et al. (2022), who highlight that the key elements of resilient supply chains are visibility, coordination, and

responsiveness. In the specific case of apparel, Agrawal and Pal (2019) and Chan (2022) suggest that traceability improves the monitoring of materials, processes, and flows across the chain, thereby enabling quicker detection of disruption points. This observation aligns with the previous studies that have noted the importance of information visibility, digital integration, and coordination in enhancing resilience (Katsaliaki et al., 2022; Ivanov and Dolgui, 2020; Dubey et al., 2021; Chan, 2022). Traceability systems can be used in globally distributed and time-sensitive supply chains, including apparel, to quickly identify the source of disruption and ensure more effective responses are carried out (Ivanov, 2020; Dubey et al., 2021). Traceability in Sri Lanka, where apparel exporters are engaged in buyer-driven global value chains and are increasingly under transparency, sustainability and compliance pressure, seems to serve as not only an information system, but also a strategic capability that helps to maintain continuity and export competitiveness. In this respect, the industry trends presented by Sri Lanka Apparel (2024) and Sri Lanka Export Development Board (2025) also support the practicality of this finding.

The second finding focused on the effect of DSCT on operational decision-making speed (ODMS). The findings verify the existence of a strong and positive relationship, which means that traceability increases the pace at which managers identify issues, evaluate options, approve actions, and organize the implementation. This observation aligns with Chan (2022), who states that traceability systems enhance real-time visibility and access to information at different stages of the supply chain. It is also consistent with the claim of Kumar and Sharma (2021) that the timely and precise information about disruptions facilitates quicker and more efficient supply chain decision-making. Theoretically, this finding is very consistent with Tushman and Nadler (1978), who suggest in Organizational Information Processing Theory that companies in uncertain situations need greater information-processing power to minimize ambiguity and enhance decision-making. In the current research, DSCT seems to enhance that information-processing capacity by rendering operational information more accessible, timely, and usable. This is especially relevant in the Sri Lankan apparel environment, where companies have to work with short lead times, high delivery demands, and high levels of buyer scrutiny. In these circumstances, any delay in decision-making may rapidly lead to delays in production, shipment, and reputational risk. From an Organizational Information Processing Theory perspective, this association suggests that traceability-enabled information visibility can reduce information-processing delays and support faster operational decision-making.

The third finding is examined the relationship between ODMS and SCR. The findings show that ODMS is positively associated with resilience, suggesting that firms that make faster operational decisions are better able to contain disruption effects, maintain continuity, and recover efficiently. This finding aligns with Baum and Wally (2003), who demonstrate that decision speed is a significant organizational capability, and with Kumar and Sharma (2021), who emphasize the significance of timely decisions in case of supply chain disruptions. The finding is also compatible with the dynamic capabilities perspective of Teece, Pisano, and Shuen (1997). In this perspective, companies should not just feel the change in the environment but also grab opportunities and reorganize resources quickly. In this study, ODMS reflects that “seizing” capability by showing how quickly managers can convert available information into coordinated action. Therefore, resilience seems to be not only a matter of the availability of traceability data, but also the rate at which this information is converted into operational action. Although both constructs involve responsiveness, ODMS refers specifically to the speed of managerial

decision-making, whereas SCR represents the broader capability to anticipate, respond to, recover from, and adapt to disruptions. The ODMS–SCR HTMT value of 0.829 remained below the 0.90 threshold, while this conceptual distinction supports their separate treatment.

It finally evaluated the mediating effect of ODMS between the relationship between DSCT and SCR. The indirect effect was significant (β = 0.376, 95% BCa CI [0.284, 0.468]), confirming statistical mediation, while the significant direct effect indicates partial mediation. VAF is reported as supplementary evidence rather than the primary basis for interpreting mediation.DSCT enhances resilience both directly and indirectly via accelerated decision-making. This is among the most significant contributions of the study. In line with Tushman and Nadler (1978), the results indicate that information does not generate organizational value unless it is processed and acted on effectively. Similarly, the dynamic capabilities view of Teece et al. (1997) can be used to understand why traceability should be accompanied by quick managerial reaction to produce resilience effects. That is, DSCT offers the informational base, and ODMS defines the effectiveness of the transformation of that information into adaptive operational action. The fact that the direct effect of DSCT on SCR was still significant also shows that traceability is a contributor to resilience in its own right by enhancing monitoring, visibility, and coordination. Nevertheless, the mediation outcome demonstrates that a significant portion of its value is achieved by accelerated internal decision-making.

From a theoretical perspective, this study contributes to the literature in several ways. First, it contributes to the resilience literature by theorizing DSCT as a specific digital capability, not a general element of overall digitalization. In this respect, the study extends the conceptual distinction made by Olsen and Borit (2013) and Roy, Schoenherr, and Charan (2021) between traceability and related concepts such as visibility and transparency. Second, the research offers a process-oriented explanation by showing how DSCT-enabled information visibility can facilitate faster managerial decisions and subsequently contribute to SCR through ODMS, as evidenced by the significant indirect association between DSCT and SCR through ODMS.Third, it introduces context-specific evidence of the apparel export industry in Sri Lanka, thus generalizing resilience research to an emerging-economy context. This is especially applicable since the previous Sri Lankan research, including that of Abeyruwan et al. (2025) and Jayasinghe et al. (2026) has focused more on digitalization, IT capability, and robustness in general, but the current study isolates traceability as a particular organizational capability and describes how it is converted into resilience.

These findings have specific meaning in the Sri Lankan context. The clothing industry is the most important export business in the country and it is highly integrated in the global supply chains that require speed, reliability, and confidence of buyers. According to Sri Lanka Export Development Board (2025), the industry contributes significantly to export earnings and employment, whereas Sri Lanka Apparel (2024) reveals that traceability is becoming a common practice. Moreover, Garcia-Torres et al. (2021) and UNECE and UN/CEFACT (2021) emphasize the growing significance of traceability and transparency requirements in the textile and apparel supply chains at the international level. Sri Lankan apparel exporters cannot afford to use only traditional recovery practices in this environment. They must combine digital traceability with fast and well-coordinated managerial responses if they are to maintain resilience and remain competitive in international markets. The Sri Lankan apparel context extends resilience research by providing evidence from an export-oriented manufacturing setting

in a developing economy, where firms face pressures related to delivery reliability, buyer requirements, and supply-chain disruptions. This provides contextual evidence on the association between traceability-enabled information visibility, decision-making speed, and resilience in a relatively underrepresented setting.

Managerially, the results indicate that traceability should not be viewed as a compliance, reporting, or auditing tool by firms. Instead, traceability should be integrated into operational decision routines and disruption-management processes. In line with the reasoning of Chan (2022) and Kumar and Sharma (2021), investments in traceability systems are expected to yield more resilience benefits when they are associated with quicker information interpretation, shorter approval delays, and enhanced cross-functional coordination. In the case of Sri Lankan apparel exporters, where the performance of delivery and buyer relations is the key to long-term competitiveness, it implies that digital traceability must be supported by organizational processes that allow responding promptly to sourcing, production, and logistics processes. Managers should integrate traceability systems with clearly defined decision protocols and disruption-response procedures. Assigning decision authority to relevant managers and using traceability alerts to identify affected suppliers, production batches, orders, and shipments can support faster operational responses. Regular disruption-response exercises can further help employees convert traceability information into timely action.

## Conclusion

This paper has investigated how digital supply chain traceability (DSCT) and supply chain resilience (SCR) are related and how the mediating variable of operational decision-making speed (ODMS) can affect them in Sri Lankan apparel exporting companies. The results show that DSCT correlates positively with both ODMS and SCR, and ODMS is positively correlated with SCR and partially mediates the correlation between DSCT and resilience. Such findings indicate that the worth of digital traceability is not limited to enhancing the visibility and transparency of information; it facilitates timely operational decisions, which is associated with stronger resilience outcomes.

The research adds to the body of literature on supply chain resilience by conceptualizing digital traceability as a specific digital capability and by offering a process-based description of how digital capability is related to resilience through managerial action. Practically, the results indicate that the apparel exporters need to combine the traceability systems with quicker decision-making to enhance responsiveness and continuity in the disruption-prone environments.

## Limitations and Future Research Directions

This study has limitations that limit the scope of the findings despite its contributions. To begin with, the research is founded on a sample of clothing exporting companies in the Western Province of Sri Lanka. Although this area is a significant center of industrial activity, the results might not be entirely applicable to other areas or industries with other structural features. Second, the research used non-probability sampling method, which was a combination of snowball and purposive sampling. This approach may introduce selection bias and limits the

generalizability of the findings to the wider population of Sri Lankan apparel exporters.Even though it is suitable in reaching knowledgeable respondents, the method can create sampling bias and restrict external validity. Third, the research is based on perceptual measures that were gathered among managerial respondents. Although these measures are typical in supply chain research, they are prone to respondent bias and might not be able to capture objective operational performance. Fourth, the cross-sectional research design does not allow causal relationships to be established. Although the significant indirect effect indicates statistical mediation, it should not be interpreted as evidence of a causal mechanism. Reverse causality cannot be excluded, as more resilient firms may be more likely to invest in sophisticated traceability systems and faster decision-making mechanisms. Fifth, DSCT, ODMS, and SCR were measured using the same questionnaire and respondents, creating potential common method bias. Although Harman's single-factor test and VIF results provided no indication of substantial bias, residual common method bias cannot be completely excluded.

This study can be enhanced in future research by using stronger research designs to enhance causal inference. As an example, multi-wave or longitudinal survey designs may be employed to obtain the dynamics over time and more effectively evaluate the directionality of relationships. Researchers can also use objective firm-level data, including traceability system usage logs, disruption response times, and recovery performance metrics, to confirm the proposed mechanism outside of perception-based measures.

Moreover, panel data techniques or quasi-experimental designs might be used in future research to overcome the endogeneity issues and isolate the causal effects better. The integration of subjective managerial evaluation with objective operational metrics would give a more detailed picture of the role of digital traceability in supply chain resilience.

Lastly, future studies can expand the model by adding more contextual variables, including environmental uncertainty, digital maturity, or complexity of supply chain, as moderating variables. Other firm-level factors, such as firm size, age, digital maturity, supply chain complexity, environmental uncertainty, export dependence, and overall management capability, may also influence the relationships examined and were not included in the present model. Comparative research across industries and nations would also contribute to the evaluation of the generalizability and strength of the relationships found in this study.

## References

Abeyruwan, N. Y., Weerasuriya, G. D. H. N., Wijesekara, J. H. T., Amarasekera, M. A. B., Wisenthige, K., & Rajapakse, V. (2025). Digitalization and export performance: Mediating role of innovation and export market orientation in Sri Lankan apparel exporters. *South Asian Journal of Business Insights*, 5(1), 40–70. https://doi.org/10.4038/sajbi.v5i1.75

Agrawal, T. K., & Pal, R. (2019). Traceability in textile and clothing supply chains: Classifying implementation factors and information sets via Delphi study. *Sustainability*, 11(6), 1698. https://doi.org/10.3390/su11061698

Ambulkar, S., Blackhurst, J., & Grawe, S. (2015). Firm's resilience to supply chain disruptions: Scale development and empirical examination. *Journal of Operations Management*, 33–34, 111–122. https://doi.org/10.1016/j.jom.2014.11.002

Baum, J. R., & Wally, S. (2003). Strategic decision speed and firm performance. *Strategic Management Journal*, 24(11), 1107–1129. https://doi.org/10.1002/smj.343

Becker, J.-M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: Guidelines for using reflective-formative type models. *Long Range Planning*, 45(5–6), 359–394. https://doi.org/10.1016/j.lrp.2012.10.001

Chan, K. K. (2022). Supply chain traceability systems—Robust approaches for the digital age. In B. L. MacCarthy & D. Ivanov (Eds.), *The digital supply chain* (pp. 163–179). Elsevier. https://doi.org/10.1016/B978-0-323-91614-1.00010-1

Chowdhury, M. M. H., Chowdhury, P., Quaddus, M., & Rahman, K. W. (2024). Flexibility in enhancing supply chain resilience: Developing a resilience capability portfolio in the event of severe disruption. *Global Journal of Flexible Systems Management, 25*, 395–417. https://doi.org/10.1007/s40171-024-00391-2

Chowdhury, M. M. H., & Quaddus, M. (2016). Supply chain readiness, response and recovery for resilience. Supply Chain Management: *An International Journal*, 21(6), 709–731. https://doi.org/10.1108/SCM-12-2015-0463

Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Dosek, T. (2021). Snowball sampling and Facebook: How social media can help access hard-to-reach populations. PS: Political Science & Politics. https://doi.org/10.1017/S104909652100041X

Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS Quarterly,* 39(2), 297–316. https://doi.org/10.25300/MISQ/2015/39.2.02

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. https://doi.org/10.1177/002224378101800104

Garcia-Torres, S., Rey-Garcia, M., Sáenz, J., & Seuring, S. (2021). Traceability and transparency for sustainable fashion-apparel supply chains. *Journal of Fashion Marketing and Management*, 26(2), 344–364. https://doi.org/10.1108/JFMM-07-2020-0125

GS1. (2017). GS1 global traceability standard: GS1's framework for the design of interoperable traceability systems for supply chains (Release 2.0). https://www.gs1.org/standards/gs1-global-traceability-standard/current-standard

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed.). SAGE.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Jayasinghe, P. S. K., Kelly, T., Madhavika, N., Ehalapitiya, S., De Costa, D. S., Liyanage, M. K., Rishdha, F., & Jayasuriya, N. (2026). Unveiling the robustness of apparel exporters' supply chains: Exploring the influence of IT capability, supply chain collaborations and government support. *The International Journal of Logistics Management*, 37(2), 397–429. https://doi.org/10.1108/IJLM-10-2024-0642

Katsaliaki, K., Galetsi, P., & Kumar, S. (2022). Supply chain disruptions and resilience: A major review and future research agenda. Annals of Operations Research, 319(1), 965–1002. https://doi.org/10.1007/s10479-020-03912-1

Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information Systems Journal*, 28(1), 227–261. https://doi.org/10.1111/isj.12131

Kumar, B., & Sharma, A. (2021). Managing the supply chain during disruptions: Developing a framework for decision-making. *Industrial Marketing Management*, 97, 159–172. https://doi.org/10.1016/j.indmarman.2021.07.007

Li, P., Chen, Y., & Guo, X. (2025). Digital transformation and supply chain resilience. *International Review of Economics & Finance*, 99, 104033. https://doi.org/10.1016/j.iref.2025.104033

Maier, C., Thatcher, J. B., Grover, V., & Dwivedi, Y. K. (2023). Cross-sectional research: A critical perspective, use cases, and recommendations for IS research. *International Journal of Information Management*, 70, 102625. https://doi.org/10.1016/j.ijinfomgt.2023.102625

Olsen, P., & Borit, M. (2013). How to define traceability. Trends in Food Science & Technology, 29(2), 142–150. https://doi.org/10.1016/j.tifs.2012.10.003

Paul, A., & Saha, S. C. (2025). A systematic literature review on flexible strategies and performance indicators for supply chain resilience. Global Journal of Flexible Systems Management, 26(Suppl 1), 207–231. https://doi.org/10.1007/s40171-024-00415-x

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. *The International Journal of Logistics Management*, 20(1), 124–143. https://doi.org/10.1108/09574090910954873

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Pu, G., Li, S., & Bai, J. (2023). Effect of supply chain resilience on firm's sustainable competitive advantage: A dynamic capability perspective. Environmental Science and Pollution Research, 30(2), 4881–4898. https://doi.org/10.1007/s11356-022-22483-1

Roy, V., Schoenherr, T., & Charan, P. (2021). Contrasting supply chain traceability and supply chain visibility: Are they interchangeable? *The International Journal of Logistics Management*, 32(3), 942–972. https://doi.org/10.1108/IJLM-05-2020-0214

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. European Journal of Marketing, 53(11), 2322–2347. https://doi.org/10.1108/EJM-02-2019-0189

Sri Lanka Apparel. (2024, March 9). Sri Lankan apparel manufacturers make traceability the norm. https://www.srilankaapparel.com/sri-lankan-apparel-manufacturers-make-traceability-the-norm/

Sri Lanka Export Development Board. (2025, February). Industry capability report: Sri Lankan apparel sector. https://www.srilankabusiness.com/ebooks/industry-capability-report-apparel-2025.pdf

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Tushman, M. L., & Nadler, D. A. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review*, 3(3), 613–624. https://doi.org/10.5465/AMR.1978.4305791

United Nations Economic Commission for Europe (UNECE), United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). (2021). Traceability and transparency in the textile and leather sector, Part 1: High-level process and data model (Business Requirements Specification; Version 1.0). https://unece.org/sites/default/files/2021-03/BRS-Traceability-Transparency-TextileLeather-Part1-HLPDM_v1.pdf